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Extruder Die Head

The invention relates to an extruder die head, preferably a blown film head, comprising a central annular channel, which is provided with an annular outlet die and into whose outer limiting wall empty annular slits, which feed a polymer melt and which constitute the smaller diameter openings of truncated channels, formed between the internal and external shells of stacked, conical insert members.

The EP 0 568 544 B1 discloses an extruder head for extruding multi-layered thermoplastic pipes of the kind described above, whose central annular channel is defined by a central mandrel, whose shell forms the inside wall of the channel, and by stacked conical insert members, which enclose said channel and whose inside openings form the outer wall of the central annular channel. In this prior art extruder head a truncated channel is formed between two bell shaped or conical insert members, which are provided with a radial feed borehole

for the polymer melt. For each tubular layer of polymer melt to be extruded there are two conical insert members, which are stacked one over the other. The space between these insert members forms the annular slits. The insert members are held together by these clamping cover parts, which are connected together with tightening screws. The prior art extruder die head exhibits a significant overall length, when multilayered pipes are to be produced. However, such long extruder die heads exhibit the drawback that the large height of the extruder die head results in long flow paths for the polymer melt. These paths in turn result in high rheological stress at the melt interfaces, a state that can lead to unstable flow behavior. In particular, the long flow paths are a problem with polymer melts that cannot tolerate heating for a prolonged period of time. Such polymer melts decompose and become brittle when heated for long periods.

Therefore, the object of the invention is to provide an extruder die head of the class described in the introductory part. This extruder die head facilitates the extrusion of plastic tubes with arbitrary layers, but is characterized by a significantly shorter construction height.

The invention solves this problem in that the annular slits, feeding the polymer melts, also empty into the inside wall of the central annular channel. The annular slits are the smaller diameter openings of truncated channels, formed between the internal and external shells of stacked conical internal insert members.

It is also easy to build the extruder die head of the invention in modules. A number of conical insert members are stacked until the desired number of layers of the extruded tube is reached. While maintaining the same number of conical feed channels, thus the same number of extruded tubular layers, it is possible to make the extruder die head of the invention half the construction length of

the prior art extruder die head, because, based on the length of the conical insert members, two annular slits that feed the polymer melt can empty into the central annular channel. The significantly reduced axial length of the extruder die head of the invention results in an improved flow pattern of the melt that is fed in and less heat stress on the melt, because the melt spends correspondingly less time in the extruder die head.

The overall length of the extruder die head of the invention can be further reduced in that the internal and external shells of each insert member define the truncated channels for feeding the polymer melts into the central annular channel. In contrast to the prior art extruder die head, this design reduces the size of the conical insert members to half of their former size so that the overall length is correspondingly shortened.

The internal and external annular slits, which empty into the central annular channel, can lie in the same radial planes. Of course, it would also be possible to move the annular slits axially.

Preferably the internal and external shells of the conical insert members are two counter rotating spiral channels, whose depth tapers off in the direction of the opening. This design of the channels, wherein the melt overflows the channels in the axial direction, is well known.

One embodiment of the invention is explained in detail below with reference to the drawings.

Figure 1 is a cross sectional view of a blown film die head with annular or conical channels, feeding five different melts.

Figure 2 is a sectional view of a blown film die head with annular or conical channels, feeding nine different melts.

Figure 1 is a schematic drawing of a sectional view of a blown film die head, where five annular or conical channels, which feed different types of polymer melts, empty into a central annular channel 1.

The blown film die head comprises a bottom annular cover 2, which serves to hold conical insert members that are stacked on said cover. A first cylindrical feed channel 3 is formed between the rings 4 and 5, which exhibit a triangular cross section. The ring's base faces are screwed or clamped together with the bottom cover 2 in a manner that is not illustrated here. The inside ring 4 exhibits a cylindrical outer wall and the outside ring 5 exhibits a cylindrical inside wall; both of these walls define an annular slit, which forms the feed channel 3. The cylindrical shell of the inside ring 4 has a helical groove, whose depth tapers off toward the top. These slotted helical passages are indicated by the three grooves 6, whose depth tapers off toward the top. The channels 7, feeding a first polymer melt, empty into the bottom helical passage 6. Stacked on the bottom rings 4, 5, which lie in a common plane, are other conical rings 8, 9 and 10, 11. The conical rings 8, 10 define with the conical areas of the rings 4, 5 the conical melt feed channels 12, 13. These conical melt feed channels empty into a central annular channel 1, which is a continuation of the cylindrical annular channel 3 and is formed between the inside and outside cylindrical shell areas of the rings 8, 10. The conical external shells of the rings 4, 5 have in turn spiral grooves, whereby the melt feed channels (not illustrated here) empty into the bottom grooves having the greatest depth.

Mounted on the conical rings 8, 10 are the conical rings 9, 11, which define with the conical external shell areas of the rings 8, 9 the conical melt feed

channels, which in turn empty into the central annular channel. The external shell areas of the rings 8, 9 are spiral grooves, whose height tapers off toward the top. The bottom grooves with the greatest depth empty into the melt feeding channels 15, 16. Mounted on the top conical inserts 9, 11 are inside and outside holding rings 17, 18, between which the central annular channel 1 is defined with an annular outlet slit 19. An easy method for assembling the blown film die head together with the bottom cover 12 is to connect the rings 17, 18 with tightening screws.

The inside rings and the bottom cover 2 exhibit aligned axial passages, which form a passage channel, which houses the lines to feed in and exhaust the blowing air for the blown film die head. The blown film die head, shown in Figure 2, exhibits in principle the same construction. The distinction between it and the blown film die head, depicted in Figure 1, lies only in the fact that between the inside and outside conical rings 8, 10 and the top inside and outside rings 9, 11 there are other inside conical rings 21, 22 and other outside conical rings 23, 24, which are designed analogously to the rings 8, 10. This arrangement of the additional conical rings makes it possible to feed, not five melts, but nine different melts with the blown film die head of Figure 2 for the purpose of producing a nine layered plastic tube.